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ABSTRACT

Criteria were developed and used to determine which of three existing computer-based instruction (CBI) lessons could be repurposed into a multimedia format. Researchers were commissioned to evaluate these three traditional linear CBI lessons by an insurance company. The lessons were updates on company policy and procedures. The repurposed CBI program would be a model project to argue for funding further multimedia efforts with the organization's decision makers. Because their time was limited, the researchers developed repurposing criteria that included instructional effectiveness, user acceptance, cost effectiveness, and organizational support. The conclusion drawn from examining each of the lessons with these criteria in mind was that existing lessons could benefit more from improved instructional design than from additional multimedia formats. The most successful way to repurpose these lessons would be to store them in compact disc format, abandon major media or strategy additions, and invest in the redesign of existing lessons. In future evaluations, the content characteristics and hypertext eligibility are expected to be considered in addition to the criteria examined in this investigation. Unless instructional design is consistent and thorough, the addition of multimedia formats may do little to enhance effectiveness. (Contains 13 references.) (SLD)

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Evaluating Computer-Based Training For Repurposing to Multimedia: A Case Study

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Introduction

"Multimedia" is a computer driven interactive communication system for various types of textual, graphic and auditory information (Gayeski, 1992). It is distinguished not only by the variety of media which may be used but also by the variety of learning and performance strategies which it may contain (simulations, direct instruction, help systems, hypertext, etc.) "Repurposing" is the alteration of instruction to suit new purposes (Tessmer & Gatti, 1992). It involves adapting the instruction's content and strategies for another instructional purpose.

This paper describes the criteria developed and used by the authors to determine which of three existing CBT lessons could be repurposed into a multimedia format. The paper contains the client's reasons for repurposing, the types of criteria that were generated to determine the instruction's repurposability, and lessons learned by the authors from the evaluation experience.

Why CBT Was Being Evaluated for Repurposing

In Fall of 1991 the client commissioned the authors to determine which of three traditional linear CBT lessons might best be repurposed into multimedia. The client was a training manager of a national insurance company. The client's department developed training materials for insurance agents working in their offices throughout the United States. Over the years the training department had developed a number of computer based training lessons, most of which were used by agents as on-site self-instructional lessons. These lessons were updates on new company policies and procedures.

The client was interested in using multimedia instruction for three reasons. First, the client wanted to use the "cutting edge" technology of multimedia for training, to maintain the department's image as an innovator in training. Second, the client thought that the department's self-instructional materials might benefit from the use of multimedia's coordinated video, audio and animation capabilities. Third, some learners (insurance agents) were ordering CD-ROM drives for their PCs, so major equipment purchases would not be necessary for these learners to use multimedia.

The repurposed CBT program would be used as a "model project" to argue for funding further multimedia efforts with the organization's decision makers. As the client's first effort into the multimedia field, the client was interested in an effective and efficient repurposing. That is, the client needed the authors to decide which module might best be instructionally enhanced at a relatively low cost by multimedia features and strategies.

Three existing CBT lessons were given to the authors for repurposing evaluation: 1) a general orientation to insurance policies and procedures, 2) an update on Medicare, 3) an outline of risk management techniques. All three lessons were in a simple tutorial format of explanation followed by practice and feedback. The modules were text based with "gratuitous" animation that supported no clear instructional purpose.

The authors were asked to examine the three CBT programs, decide which was the best candidate for repurposing, and submit a short report about the evaluation effort. Each author was to be paid for only 5 hours of work, so the evaluation had to be conducted quickly. To that end, the authors decided to develop an evaluation job aid that both would use to evaluate each CBT lesson (Figure 1).

What Repurposing Criteria Were Used

After examining multimedia literature, the authors decided that each lesson should be evaluated to determine the potential *success* of repurposing that lesson. "Success" was defined as the predicted potential for a lesson's instructional effectiveness to be increased through the use of multimedia and of the feasibility of repurposing the lesson within the client's budget. Four major evaluation criteria were established:

- instructional effectiveness
- user acceptance
- cost effectiveness
- organizational support

Each of these criteria will be discussed in light of the evaluation questions they generated.

To What degree will the instruction's effectiveness be enhanced through multimedia conversion?

The first concern was to determine if and how multimedia could make the existing CBT lessons more effective. A more effective program would increase students' workplace skills via improved mastery and transfer of lesson outcomes. To that end, the authors answered three questions:

What are the major learning outcomes of the lesson? The lesson outcomes (concept learning, problem solving) determine what strategies and tactics may be useful for the instruction. Previous research by the authors in the design of expert system job aids indicated that learning outcomes were the most important criterion when making decisions about instructional strategies and tactics. These strategies and tactics in turn determine what multimedia attributes may be most useful. As Knight (1992) indicates, technology should be driven by design needs, not technological needs.

What media may be used to enhance the learning of the CBT outcomes? Can digital video, animation, or audio be used to improve the explanations, practice or feedback of these three CBT tutorials? Based on the lesson's learning outcomes and instructional tactics, will the addition of media features enhance presenting the information, providing practice or feedback, helping the learner access knowledge? For example, will the addition of animation or video help clarify the lesson's insurance policy information, or make its practice more realistic?

What multimedia strategies may enhance the learning of the CBT outcomes? After considering how media may or may not enhance the existing lesson strategies, the next step was to consider if new multimedia strategies could be added to increase instructional effectiveness. Multimedia is more than a collection of different types of audiovisual media, it is a strategy system of different learning and performance interventions within these media. Expert systems, simulations, and hypertext systems can be part of the instructional platform. Noninstructional features such as help systems and telecommunications may also be part of it (Gayeski, 1992).

By determining the lesson outcomes of each CBT lesson, the authors found it easier to determine which multimedia strategies and media might best enhance the lesson's learning. In this case study, two of the CBT lessons were primarily verbal information lessons that required memorization and recall of policy information. The third (Risk Management) contained procedural (low level problem solving) outcomes, although the lesson's instruction and practice was designed for verbal information learning. Based

on these outcomes, the question was: can multimedia media or strategies enhance the verbal information or procedural instruction of these lessons?

Can the CBT lessons be cost-effectively repurposed to multimedia?

Cost effectiveness was a particularly strong consideration in this project because it was also to be a demonstration project to the rest of the organization.

Multimedia development is resource-intensive. Multimedia projects may cost as much as \$200,000 (Hoekema, 1992) and may take 200-500 hours of programming for every hour of instruction (Merrill 1990; Stone, 1993). Once feasible media and strategies were determined in this project, the authors had to determine if the media and strategies could be developed within the relatively austere project budget. To do this, three questions had to be answered:

What would it cost to develop the intended multimedia interventions for the repurposed lesson? For example, what would it cost to develop a video simulation for practice in risk management? Multimedia media and strategies vary in development expense: graphics and simple animations are far less costly than digital video; simple hypertext systems may be less costly than simulations. Each proposed multimedia lesson had to be cost-evaluated for the multimedia strategies and media that would be effective in it.

How long would it take to develop the interventions? Like CBT, multimedia development costs may be difficult to estimate. However, the authors felt that more time consuming interventions would not only take more time but had a greater potential for cost overrun. For example, an expert system intervention is time consuming, complex, and difficult to cost-estimate. An on line job aid system is less complex and easier to estimate.

What potential development problems might occur in developing the interventions? Multimedia projects are often subject to time and cost overruns (Whitten, 1992) and may even come to a standstill (Knight, 1992). Different types of multimedia instruction may have more anticipated problems. For example, a hypermedia use of multimedia could present considerable interface development problems and costs. Expert systems may incur unexpected task analysis and debugging costs. A given multimedia intervention may require a considerable "fudge factor" in its cost estimates

because of its potential for unanticipated development problems and cost overruns.

Assessing the cost-effectiveness of the proposed repurposing effort requires a "reality check" into the state of the art of multimedia development. At present, there are few documented studies of the time and costs necessary for multimedia development, only a number of narrative reports that indicate that the projects took considerably more time or money than anticipated.

As with most projects, the only feasible multimedia interventions were those that would fit the client's initial budget. Thus, potential multimedia strategies were first chosen for their instructional effectiveness and then selected for their cost-effectiveness. Once these instruction and cost-effective interventions were selected, they had to pass through the next evaluation consideration, user acceptance.

Will users accept the multimedia instruction?

Users may lack the skills, motivation or attitudes to use a multimedia system effectively (Trumbull et al, 1991). Users (learners) must then be willing and able to use the repurposed instruction. To assess user acceptability, the authors made three determinations:

Will software or equipment have to be purchased by users? Many of the users (insurance agents) had purchased CD-ROM systems within the last two years. Consequently, they would probably be unwilling to purchase any new equipment or operating software. Thus, the only feasible multimedia interventions would be those that required no new equipment purchases.

Will the media and strategies be easy to use? Strategies such as hypermedia, hypertext or expert systems may require special training and self-directed learner attitudes. Learners would be using the instruction individually at their own work sites, with little help or training in how to use it. Ongoing research by the authors has shown that even the best students experience difficulty in assuming control of their learning. Consequently, the multimedia instruction must be easy to use with minimal user training and with no special computer literacy skills (e.g. database operation, image manipulation). Simple hypertext programs with an intuitive interface might work, while a complex hypermedia system may not.

Will the equipment be easy to use? As with any new technology, learner equipment skills can determine if the instruction is used at all (Tessmer & Harris, 1992). Since all learners already owned CD-ROM units and PC-AT computers, equipment literacy was not a major problem. This consideration, coupled with the fact that learners were situated by themselves, reinforced the notion that any feasible multimedia option should not require the purchase of new equipment.

User acceptance factors eliminated such options as expert systems, complex simulations or hypertext systems and digital video, which were also suspect because of their cost. This project demanded that a CBT lesson be repurposed into a multimedia format that made the instruction substantially more effective, could be cost-effectively developed, and would be accepted by its potential user audience. The final consideration was whether the organization would support such a development effort.

Will the organization support the multimedia repurposing effort?

Multimedia technology development may require extensive organizational sponsorship and advocacy (Whitten 1992; Jones, 1990). It is not enough to have permission for initial high-tech development efforts, extensive support is also needed. In developing new technology costs and benefits may be difficult to estimate, development time frequently exceeds the original estimates, and products may require extensive debugging (Whitten, 1992). Consequently, there must be strong support for the initial multimedia development effort or original efforts must be very simple to avoid these development problems.

As a final check of project feasibility, the authors queried the client about departmental and organizational attitudes toward multimedia development. The client's responses indicated that support was "cautiously optimistic" about the use of the multimedia, since it was an unknown medium that would be replacing traditional and accepted CBT formats. The organizational attitude indicated that any multimedia interventions selected for repurposing the CBT should have a high probability of staying within budget limits and predicted development times.

Evaluation Results: Should CBT be Repurposed,?

Given these four evaluation criteria, the authors concluded that none of the three CBT lessons were worth repurposing, for these reasons:

- **Level of outcomes.** Two of the lessons were verbal information tutorials with explanations followed by memorization practice. Additional media formats or sophisticated strategies were of little use. An instructional text or on-line job aid might prove more effective and far less costly.
- **Potential utility of media.** All three of the lessons involved learning text-based information. No visuals, motion or sound were part of the content or outcomes. Consequently the addition of different media would not serve to better explain the information contained in the lessons.
- **Cost-effectiveness and organizational support.** The third lesson on risk management contained problem solving outcomes that might benefit from the addition of an expert system advisor, workplace examples, and on-line job aids. However, the construction of either of these had a probability of far exceeding the budget and time of the project, which might endanger future multimedia development support from the organization.

The primary benefit of using a CD-based system for these CBT lessons was not effectiveness but convenience. The CD format would allow each multi-disc lesson to be stored on a single disc. This would eliminate the tedious task of loading and switching CBT lesson discs.

The authors concluded that existing lessons could benefit more from improved instructional design than from additional multimedia formats. For example, the practice diagnostics and feedback systems could be greatly enhanced in the existing lessons, and development money might better be spent for this task than for multimedia development. A needs assessment could also be a worthwhile pursuit before any multimedia development. A front-end analysis of agents' workplace needs could indicate that the verbal information lessons would be better designed as ready reference or hypertext sources than tutorials, or that the verbal information outcomes be part of higher order job skills instruction. The CBT navigational systems could be redesigned to make the lessons easier to use.

Considering cost and learning effectiveness factors, the authors judged that the most successful way to "repurpose" the existing CBT lessons would

be to store the lessons on CD format, abandon any major media or strategy additions, and invest the money on the redesign of the existing lessons. Both CD and disc users would benefit from the design, the project would have a high probability of being done on time and under budget, and the success of this modest initial effort could be used as justification for investment in more complex, workplace skills-based multimedia such as performance support systems. To improve the instruction, good instructional design was more important than cutting edge technology features.

Lessons Learned

The client's reasons for using multimedia exemplify some of the problems that plague the design of effective instruction:

- clients come to designers with media solutions rather than problems,
- the media itself is seen as the solution, rather than its particular features or symbol systems,
- cutting edge" technologies are sought because of their image or appeal, what Hannifan and Phillips refer to as "techno-centric design." (1987, p. 44).

As a counterbalance to these problems, the client at least asked designers to assess the worth of the (multi)media's use for instruction, an opportunity denied many designers in project work (Wedman & Tessmer, 1993).

In developing the evaluation criteria for this project, it became apparent that *appropriateness* and *readiness* were complementary criteria. "Appropriateness" is concerned with the effectiveness of multimedia's media features, instructional strategies, and cost. "Readiness applies to the user's capability to easily employ multimedia and the organization's willingness to support the multimedia development effort. The evaluation job aid (Figure 1) facilitated appropriateness and readiness evaluation across the three lessons.

Reviewing the four evaluation criteria used in the project, the authors concluded that in the future they would emphasize two more considerations: content characteristics and hypertext eligibility. The instruction's content determines if the content involves word, image, or motion characteristics (e.g. butterfly identification may involve word, image & color but not

motion). In addition to learning outcomes, the content may also determine if any multimedia media formats are suitable for the instruction. In this project, the content was primarily verbal (policy and law information). As such, video, audio, or sound would not have substantially enhanced the content delivery. Hypertext is an instructional strategy that can be useful for all types of instructional outcomes. Compared to hypermedia or multimedia development, it is comparatively inexpensive and easy to develop. It is also suitable for learning large amounts of information and later accessing it in the workplace. The use of hypertext should be one of the first considerations in CBT or multimedia development projects, particularly those with large amounts of information.

For workplace "instruction," the use of multimedia platforms may be more useful as a performance support system than a simple instructional tool. A performance support system may contain an integrated system of data, advice, and instruction (Carr, 1992). If the ultimate goal of multimedia instruction is to improve work performance, as it was in this project, the multimedia development goal may be best redirected to media and strategies that sustain and improve everyday work performance.

For any repurposing project, it may be most valuable to consider the instructional design of the project first, the outcomes intended and the strategies used to deliver these outcomes. Unless the design is consistent and thorough, the addition of multimedia formats may do little to enhance learning effectiveness.

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